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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/539,593

06/17/2005

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EXAMINER

HOBAN, MATTHEW E

ART UNIT

PAPER NUMBER

1709

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<p align="center"><b>Office Action Summary</b></p>	<p><b>Application No.</b></p> <p>10/539,593</p>	<p><b>Applicant(s)</b></p> <p>SHIRAKAWA ET AL.</p>	
	<p><b>Examiner</b></p> <p>Matthew E. Hoban</p>	<p><b>Art Unit</b></p> <p>1709</p>	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 9-21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8 is/are rejected.
- 7) ☒ Claim(s) 5 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 June 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>5/23/2006</u> . | 6) <input type="checkbox"/> Other: ____.  |

## **DETAILED ACTION**

### ***Status of Application***

Claims 1-21 of the current application are pending and presented for examination

### ***Election/Restrictions***

1. Restriction is required under 35 U.S.C. 121 and 372. This application contains the following inventions or groups of inventions, which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 1-8, drawn to a powder comprising single crystal barium titanate with no voids. This invention falls under class 501, subclass 10.

Group II, claim(s) 9-10, drawn to a suspension (slurry or paste) comprising single crystal barium titanate with no voids. This invention falls under class 252, subclass 572.

Group II, claim(s) 11-12, drawn to a dielectric material comprising the single crystal barium titanate with no voids. This invention falls under class 361, subclass 311.

Group III, claim(s) 13-14, drawn to a piezoelectric material comprising the single crystal barium titanate with no voids. This invention falls under class 252, subclass 62.9PZ.

Group IV, claim(s) 15, drawn to a dielectric film material comprising the single crystal barium titanate with no voids. This invention falls under class 251, subclass 311.

Group V, claim(s) 16, 18-19, drawn to a capacitor comprising the single crystal barium titanate with no voids. This invention falls under class 361, subclass 321.1.

Group VI, claim(s) 17, drawn to a capacitor composed of piezoelectric material comprising barium titanate with no voids. This invention falls under class 361, subclass 280

Group VII, claim(s) 20, drawn to a printed board comprising dielectric film comprising the single crystal barium titanate with no voids. This invention falls under class 427, subclass 96.1.

Group VIII, claim(s) 21, drawn to electronic equipment using a capacitor comprising the single crystal barium titanate with no voids. This invention falls under class 326, class 136.

The inventions listed as Groups I-VIII do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: The technical feature of Group I, which is the feature that is common to all eight groups, is not a special technical feature. This is due to the fact that the feature is not novel and is not a contribution over the prior art. High purity barium titanate of small particle size and high purity is present in the prior art. An example of this product can be found in the method used by S. Wada et al (S. Wada "Preparation of nm-ordered Barium Titanate Fine Particles using the 2-step Thermal Decomposition of Barium Titanyl Oxalate and Their Dielectric Properties", Proceedings of the IEEE International Symposium on Applications of Ferroelectrics, 13<sup>th</sup>, Nara, Japan, May 28-June 1, 2002 (2002), 263-266). The invention of Wada is impurity and defect free and has a specific surface area greater than .1 m<sup>2</sup>/g. Furthermore, Wada's invention has no additives or dopants. For this reason, the composition of claims 1-8 can not be considered a special technical

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feature. For this reason, there is no unity of invention and therefore restriction between the inventions is proper.

2. During a telephone conversation with Abraham J. Rosner on August 20, 2007 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-8. Affirmation of this election must be made by applicant in replying to this Office action. Claims 9-21 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

### ***Information Disclosure Statement***

The information disclosure statement filed 6/17/2005 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. The NPL listed on the IDS was not provided. It has been placed in the application file, but the information referred to therein has not been considered.

### ***Drawings***

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the Infrared Spectrum of the heat-treated barium titanate particles, wherein no abrupt peak is detected at around  $3500\text{ cm}^{-1}$  must be shown or the feature(s) canceled from the claim(s). It is

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stated that these spectra were obtained for all Inventive Examples. No new matter should be entered.

2. The drawings are objected to under 37 CFR 1.83(a) because they fail to show the lack of voids in the barium titanate particles as described in the specification. Inventive examples 3 and 4 specifically mention that TEM images were obtained, but the application fails to include these images. Given that this is an essential element of the invention and claims are subsequently made based on these obtained images, therefore an image is necessary for the claimed invention to be truly enabled. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d).

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

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the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Claim Objections***

3. Claim 15 objected to because of the following informalities: The word detected is misspelled. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The sentence structure in claim 1 is awkward and the object of the modifying clauses "having a diameter of 1 nm or more" and "in an amount of 20% or more" is uncertain. These two phrases, especially the first, could modify either the actual particles or the voids within the particles. Furthermore the second clause could go to modify the number of particles or the porosity of the particles. The problems recited with this sentence structure is also extended especially to claims 2 and 3, but also to all claims with an antecedent basis to claim 1.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4 and 6-8 are rejected under 35 U.S.C. 102(a) as being anticipated by S. Wada et al (S. Wada "Preparation of nm-ordered Barium Titanate Fine Particles using the 2-step Thermal Decomposition of Barium Titanyl Oxalate and Their Dielectric Properties", Proceedings of the IEEE International Symposium on Applications of Ferroelectrics, 13<sup>th</sup>, Nara, Japan, May 28-June 1, 2002 (2002), 263-266).

The instant claims detail a barium titanate, which is a powder of single crystals in the form of particles made by wet process, wherein 80% or more of the particles do not contain a void having a diameter of more than 1nm. These particles also have a BET specific surface area of .1 m<sup>2</sup>/g or more.

The disclosure of Wada teaches the creation of nm-size barium titanate particles that are defect and impurity free (See abstract and pg. 265 column 2). Overall Wada's invention is a thermally decomposed Barium titanyl oxalate that goes through a modified two step process. Upon completion of this process it was found that the product was single crystal, defect and impurity free, which reads directly on claims 1-3 of the instant application. The exact percentage of defect free particles is not directly recited, however the language of the author leads one to reasonably believe that the particles were nearly all of the particles created were free of defects (Relevant to claims 1-3). The particles of Wada were stated as having a size of 16.5 nm, as verified through TEM observation, by simply calculating under the assumption that the particles were perfect spheres this leads to a specific surface area of 62.9 m<sup>2</sup>/g. Other factors in this calculate were density, which was recited as being 5.89 g/cm<sup>3</sup> by Wada. The assumption of the particles being perfect spheres is a sound one, even if the particles were elliptical with a



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high aspect ratio, their specific surface area would still be much greater than the value of .1 m<sup>2</sup>/g as recited by the instant claims (Relevant to claim 4). The final product of Wada's research did not incorporate any dopants or additional elements as recited in claim 6. Finally the products attained by Wada were in the form of powders (See Experimental Section, Paragraph 1) (relevant to claim 7). The major difference between the two processes is the fact that Wada uses a solid state thermal decomposition process, where the applicant uses a wet process; however, the process by which these powders were obtained gives no grounds for patentability, since the final products appear to be exactly the same. Both products are free of internal hydroxyl groups, which cause defects and voids of over 1 nm, and both have relatively high specific surface area, due to their small size (relevant to claim 8).

### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 5 rejected under 35 U.S.C. 103(a) as being unpatentable over Wada et al (S. Wada "Preparation of nm-ordered Barium Titanate Fine Particles using the 2-step Thermal Decomposition of Barium Titanyl Oxalate and Their Dielectric Properties", Proceedings of the IEEE International Symposium on Applications of Ferroelectrics, 13<sup>th</sup>, Nara, Japan, May 28-June 1, 2002 (2002), 263-266) in view of Venigalla et al (US Application Number 10/244828, thus forth referred to as '828).

The instant application claims a barium titanate, which is single crystal in the form of particles, where 20% of the particles do not have a void greater than 1 nm in diameter. Furthermore, the application claims that there is no abrupt peak detected at around 3500 cm<sup>-1</sup> by infrared spectrum analysis of the particles after heat treatment thereof at 700C.

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In reference to the disclosure of the instant application, detection of an abrupt peak at around  $3500\text{ cm}^{-1}$  by infrared spectrum analysis refers to the presence of hydroxyl groups in the sample

Wada et al teaches a barium titanate, which is **single crystal** in the form of particles, where the sample is **defect-free and impurity-free** (no voids greater than 1nm in diameter). The paper states that there are no internal hydroxyl groups, however hydroxyls are adsorbed on the surface of the particles (see page 265, column 2). These results were obtained through infrared spectroscopy and thermogravimetric analysis.

The difference between these two products is the fact that the one of the instant claim apparently contains no adsorbed hydroxyl groups, while the product of Wada et al does.

However, the removal of adsorbed hydroxyls is an aspect taught by '828 in the following passage:

"[0020] One method involves heating the barium titanate-based particles to remove hydroxyl groups (i.e., OH.sup.-groups) from particle surfaces. The hydroxyl groups may be ionic species, or may be part of a compound (e.g., H.sub.2O). The hydroxyl groups may be chemically, physically, or otherwise attached or associated with the particle surfaces. In particular, barium titanate-based particles that are produced using a

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hydrothermal process and conventionally dried generally have hydroxyl groups attached to their surfaces. Thus, such barium titanate-based particles are particularly well-suited to be treated using this heating method. In some cases, hydroxyl groups resulting from hydrothermal processing comprise between about 1% and about 2% of the total weight of the particulate composition. It is to be understood, however, that barium titanate-based particles produced using other processes may also have hydroxyl groups attached to their surfaces and can be treated using the heating method.

[0021] The hydroxyl groups are removed by heating the particles to a sufficient temperature and for a sufficient time so as to cause the hydroxyl groups to detach from particles surfaces. The specific heating conditions may depend upon characteristics of the particulate composition including composition size and particle size amongst others. Conventional drying temperatures (e.g., 200.degree. C. or less) have been found to be too low to sufficiently remove hydroxyl groups from particle surfaces. The heating step is generally carried out at temperatures and times that are insufficient to cause substantial particle growth and insufficient to cause particle sintering. In one set of embodiments, the particles are heated to a maximum temperature of greater than about 300.degree. C. and less than about 500.degree. C. to remove the hydroxyl groups. In some embodiments, the maximum temperature is between about 350.degree. C. and about 450.degree. C. (e.g., about 400.degree. C.). It may be desirable to maintain the particulate composition at a relatively constant temperature between about 300.degree. C. and about 500.degree. C. for a dwell period. Though in other cases, the particulate

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composition is heated to the maximum temperature within this range but then cooled without the dwell period.

[0022] Heating time generally depends on the size of the particulate composition and can be readily determined by one of ordinary skill in the art. Any suitable heating system (e.g., furnace, vacuum furnace) can be used to heat the particles. After heating the particles are cooled, generally to room temperature.”

Thus, It would have been obvious to one of ordinary skill in the art to remove hydroxyls at the time the invention was filed when Wada is modified in view of US '828 because US '828 teaches the use of the above heating process is said to remove adsorbed hydroxyl groups from barium titanate. Although this process is specifically designed for use with particles obtained through hydrothermal synthesis, the inventor states that barium titanate obtained through other processes can be heat-treated and refined using the above process.

The particles created by Wada only had hydroxyl's adsorbed to the surface, and had no internal lattice hydroxyls. Normally, the removal of hydroxyls would cause defects in the particles; however, these defects are associated with the removal of hydroxyls from the internal cavities of the particles and are not associated with the removal of adsorbed hydroxyls. Since only adsorbed hydroxyls would be removed from Wada's particles, since there were no internal hydroxyls, no defects would arise from the heat treatment

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proposed by '828. Finally after this heat treatment there would be no hydroxyls adsorbed on the surface of the particles or in the lattice of the barium titanate, meaning that there could be no hydroxyls in or on the particles leading to the absence of an IR peak at  $3500\text{ cm}^{-1}$ .

There is significant motivation to combine these two inventions because a particle of barium titanate with less surface impurities leads to a sintered final product with better, more consistent properties. It is well known in the art that hydroxyls, on the surface or internal, decrease the capacitance of any barium titanate capacitor.

### ***Double Patenting***

8. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

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9. Claims 1-8 provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2 of copending Application No. 10/189,371. Although the conflicting claims are not identical, they are not patentably distinct from each other because the products of each application are apparently created by the same process as is disclosed and is later claimed in claims 3-12 of the copending application.

Many of the details of the barium titanate are not claimed in '371, but the form of the particles as a powder, and their creation means through wet processing, are substantially the same.

The additional properties mentioned by the instant application, such as the lack of voids having a diameter of over 1 nm, as well as the lack of an abrupt peak at  $3500\text{ cm}^{-1}$  under IR spectroscopy, would be inherent in the product as claimed by Claims 1-2 of Application No. 10/189,371. Furthermore, the specific surface area of the particles claimed in '371 would be the same as those of the instant application, which is evident in the inventive examples (many of which are similar to those of the instant application). The discovery of new properties of a known material does not make it patentably distinct.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

***Conclusion***

IN RETROSPECT, claims 1-24 were subject to restriction requirements, where claims 1-8 were elected. Furthermore, claims 1-8 are rejected for various reasons as detailed in the preceding office action. In addendum, the drawings and Claim 5 are objected to. Claims 9-21 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

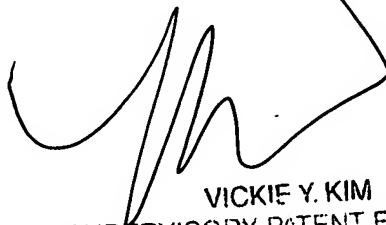
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Hoban whose telephone number is (571) 272-3585. The examiner can normally be reached on Monday - Friday from 7:30 AM to 5 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on (571) 272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you



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have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

A handwritten signature in black ink, consisting of a large, stylized 'V' followed by a series of loops and a final upward stroke.

VICKIE Y. KIM  
SUPERVISORY PATENT EXAMINER